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Abstract

We leverage a joint model of consumer vehicle choice and charging station supply to evaluate the impacts of recent and potential policy changes on electric vehicle (EV) adoption and related outcomes: the One Big Beautiful Bill Act (OBBBA) withdrawal of tax credits for EV purchases, batteries, and charging infrastructure; potential termination of the Infrastructure Investment and Jobs Act's (IIJA) funding for chargers; potential introduction of a $250 annual EV fee; and potential revocation of the Clean Air Act waiver allowing California to set more stringent emissions standards and other states to follow suit. The model segments the nation into states that do and do not follow California's zero-emissions vehicle (ZEV) requirements to simulate interactions between those requirements and other policies. The single policy change with the largest impact on EV adoption is the OBBBA's removal of the EV tax credits, while the potential suspension of the IIJA's charging infrastructure funds promises the smallest fiscal savings per reduction in EV adoption. The OBBBA alone reduces the projected 2030 EV share of new vehicles from 48.0% to 39.4%. Revoking the California waiver would have minor impacts were other policies left in place, but has significant impacts when they are removed.

Introduction

In 2023, light duty transport accounted for 16% of U.S. greenhouse gas emissions from the use of energy. The electrification of light duty transport, paired with decarbonization of the power sector, is widely seen as the key step in reducing those emissions. The Biden Administration made electric vehicle (EV) adoption a key component of U.S. climate policy, particularly through the implementation of EV and charger tax credits in the Inflation Reduction Act (IRA) and through federal funding for charging infrastructure via the National Electric Vehicle Infrastructure (NEVI) program established by the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law. Previous research has documented the expected benefits of these policies for EV adoption and resulting carbon emissions reductions.[1,2,3]

The change in U.S. presidential administrations has seen a reversal of these pro-EV policies, with many of the IRA incentives eliminated and others facing potential elimination. In his Inauguration Day executive order, *Unleashing American Energy*,[4] President Trump promised to terminate support for EVs in the IRA and IIJA and to end the zero-emissions vehicle (ZEV) mandates associated with California's Clean Air Act waiver (CA waiver), which allows the state to set its own more stringent air quality policies and other states to follow. Since then, Congress has revoked the CA waiver, although the State of California challenged the withdrawal in court.[5] The One Big Beautiful Bill Act (OBBBA) eliminated the IRA's tax credits for EVs and charging infrastructure and placed restrictions on the production tax credit for EV batteries and critical mineral processing.[6] A $250 annual EV fee in the House version of the OBBBA was eliminated by the Senate but may be reconsidered.[7] The fate of NEVI is uncertain: the U.S. Department of Transportation (DOT) withdrew NEVI guidelines and instructed states to pause disbursements in February[8], the U.S. Government Accountability Office (GAO) ruled in May that the NEVI pause was illegal[9], and in June the White House instructed the DOT to ignore the GAO's ruling[10]. Later that month, a District judge required the DOT to restore funding to 14 states.[11] In August, the DOT released updated NEVI guidelines which left the original regulations unchanged.[12] The U.S. Environmental Protection Agency (EPA) and DOT under the Trump Administration has proposed eliminating the rules on tailpipe greenhouse gas emissions ("tailpipe rule") in conjunction with its proposal to rescind the Endangerment Finding. In addition, the OBBBA effectively eased the CAFE standards by eliminating fines for automakers that fail to comply.[13]

In this paper, we use a joint model of consumer vehicle choice and charging station buildout[14] to estimate the impacts of (a) the changes to EV and charging incentives made in the OBBBA and (b) potential further changes and rollbacks of incentives. To shed light on the OBBBA provisions, we separately estimate their individual contributions, noting that the sum of the components differs from the effect of simultaneously making all changes because of model nonlinearities and endogenous private sector charging station build-out. Prior versions of the model can simulate changes in national monetary incentives for EVs and national charging infrastructure.[3,13] The major methodological innovation in this paper is modeling the CA waiver by segmenting the national population of EVs and chargers into states that do and do not follow California's most recent ZEV policies. We implement the standards in the relevant states via a tradeable permit that effectively subsidizes EVs and taxes internal combustion engine (ICE) vehicles to meet the standard.

Some policy changes are outside the scope of this analysis. Increasing tariffs on imported vehicles and parts also stymie EV sales, but those tariffs also apply to ICE vehicles and there is insufficient data to assess the relative tariff effects on EVs vs. ICEs. CAFE and tailpipe standards play no role in our model as they were non-binding under the Biden administration and are not enforced under the Trump administration because Congress eliminated fines for non-compliance.[13]

We estimate that the OBBBA's elimination of the IRA EV-related tax credits will reduce the 2030 EV sales share of new vehicles from 48.0% to 39.4%, relative to a December 2024 policy baseline. Of the policies we consider that make up the OBBBA, the largest single reduction in the 2030 EV sales share (6.2 percentage points) comes from the elimination of the tax credits for new, used, and commercial EV purchases (including retail leases), which was as much as $7,500 under the IRA for vehicles and batteries meeting certain domestic content standards plus up to $4,000 on resale as a used vehicle.

The components of the OBBBA together are projected to reduce the number of EVs on U.S. roads in 2030 by 23.3%, increase carbon emissions from light-duty vehicles in 2030 by 41.0 million metric tons, and save the U.S. government $170.5 billion in 2024 USD during the 2026-2035 budget window. Of those savings, the vast majority come from the repeal of the IRA EV tax credits. When the two components of the OBBBA changes are simulated separately, repealing the EV tax credits saves $169.2 billion between 2026 and 2035, whereas repealing the IRA charger tax credits saves only $15.6 billion over the same timeframe. Repealing the EV credits yields more taxpayer savings per additional unit of CO_2 emissions and per unit of lost EV sales than does repealing the IRA charger tax credits. In other words, the charger tax credits were a more cost-effective method to support EVs than were the EV tax credits.

Among potential changes above and beyond the OBBBA – repealing NEVI, revoking the CA waiver, repealing the IRA production tax credit ("Section 45X"), and adding a $250 annual EV fee – revoking the NEVI charger support has the largest individual effect, reducing the 2030 EV share of new vehicle sales by a further 4.3 percentage points to 35.1% in 2030. The other three policy changes each reduce the 2030 sales share by less than 2 percentage points relative to the OBBBA baseline. Revoking the CA waiver has almost no cumulative effect on the number of EVs on the road in 2030 because its ZEV requirements do not bind in expectation until close to 2030, except when all other policy changes are implemented. Together, these four policy changes – repealing NEVI, revoking the CA waiver, removing the IRA production tax credit, and adding the $250 annual EV fee – are estimated to reduce the 2030 EV share of new vehicle sales to 30.6%, 8.7 percentage points below the OBBBA baseline and 17.4 percentage points below the December 2024 policy baseline.

Results

The simulation model combines a logit discrete choice model of consumer choice between EVs and equivalent ICEs with an entry-exit model for Level 2 and Level 3 charging stations.[3,11,17,18] In each year, consumers within two vehicle types (cars and SUVs/light trucks) choose between an EV and an ICE based on their relative price (including operation and maintenance costs and net of any subsidies), the number of public Level 2 chargers per EV, the total number of public Level 3 (DC fast) chargers, a population-level characteristic drift for electric vehicles which captures evolving public acceptance of EVs and changing EV characteristics, and an individual-by-year logit taste shock. In parallel, Level 2 and Level 3 charging firms choose how many chargers to deploy by equating costs and net present benefits, yielding a charging station supply that is a function of the numbers of EVs and other chargers of the same level on the road.

The main modeling innovation relative to prior work[14] incorporated here is the segmentation of the EV market into "ZEV states" – those that had adopted California's Advanced Clean Cars II (ACCII) policy under the California Clean Air Act Waiver – and "non-ZEV" states. The ZEV states are California, Colorado, Delaware, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, and Washington, plus Washington, D.C. States that adopted previous California ZEV policies, but not ACCII, are not included as ZEV states here: Connecticut, Maine, Minnesota, Nevada, and Virginia[19]. The model therefore has 8 modeling cells (EV/ICE x SUV/car x ZEV/non-ZEV). Car purchasers are influenced by the number of local Level 2 chargers per EV (approximated by the ZEV or non-ZEV group average) and, because cars are also used for long-distance road trips, the number of national Level 3 chargers. The supply of Level 2 chargers depends on the local number of Level 2 chargers per vehicle, while the supply of Level 3 chargers depends on the national population of EVs. See Methods for the full set of equations.

Implementation of ZEV mandates: California's ACCII policy imposed minimum rates of zero-emissions vehicle sales beginning with 35% in 2026 and escalating to 100% in 2035. Previous zero-emissions vehicle mandates in California imposed requirements beginning with a 12% ZEV share in 2021 and ending with 22% in 2025. For simplicity, we model any states that adopted ACCII under the CA waiver as adopting the full trajectory of requirements from 2021 to 2035 and beyond, and any states who have not adopted ACCII as having no ZEV requirements, though there are in fact states that adopted the pre-2025 ZEV mandates but not ACCII. In ZEV states, we implement the zero-emissions vehicle mandate via a tradable permit system that effectively subsidizes EVs and taxes ICEs so that the ZEV constraint is exactly met. The tradable permit system applies to the consolidated EV market so allows trading across vehicle classes and is assumed to have a price cap (an alternative compliance price, set to $10,000 subsidy per EV). Specifically, let m be the mandated EV share in ZEV states in year t. Let the sale of an EV generate one tradeable ZEV credit; then for the market for tradeable credits to clear, the sale of an ICE must require the retirement of m / (1 - m) tradeable credits. Let $s_{jt}(x)$ be the EV share attained in ZEV states at time t when the log of the EV-ICE price ratio is x, holding fixed other characteristics of the market (charging station buildout, taste for EVs, etc.). Then if λ_j is the share of new car sales in class j (j = car or SUV/light truck), the market-clearing tradeable credit price p is the minimum of the alternative compliance price and p satisfying:

That is, the tradeable credit price will be the price such that the sales-weighted average EV share between cars and SUVs exactly meets the ZEV standard. In years in which the mandate does not bind, the tradeable

$$m = \lambda_{car} s_{car}\left(ln\left(\frac{P_{EV,car} - p}{P_{ICE,car} + p \times m(1-m)}\right)\right) + \lambda_{SUV} s_{SUV}\left(ln\left(\frac{P_{EVS,UV} - p}{P_{ICE,SUV} + p \times m(1-m)}\right)\right)$$

credit price is zero.

Because the network of Level 3 charging stations depends on the national population of EVs, binding mandates in ZEV states impose positive spillovers on adoption in non-ZEV states via increased charging station supply.

Scenarios: There are two baselines, the December 2024 baseline (IRA, IIJA, and NEVI all in effect) and the OBBBA baseline, which is December 2024 plus the changes legislated in the OBBBA. The specifics of the individual policies that comprise the two baselines are given in Table 1. The OBBBA collectively, and its components separately, are evaluated relative to the December 2024 baseline. The modeled OBBBA provisions are: the elimination of the $7500 EV tax credit for qualifying new vehicles; the elimination of the $4000 tax credit for qualifying used vehicles; the elimination of the "leasing loophole" through which EVs purchased by individuals were eligible for the commercial tax credit if leased; and the elimination of IRA tax credits for residential and commercial charging infrastructure.[20] The model does not address commercial fleets, which represent about 20% of new vehicle sales, and thus not the elimination of the corporate EV tax credit for non-leased vehicles.

The remaining potential actions, which were not in the OBBBA and have not been taken or fully adjudicated as of this writing, are evaluated relative to the OBBBA baseline. Specifically, although the CA waiver was repealed in a Congressional Review Act review (signed June 12, 2025), that action is under litigation because it is not clear that the waiver was subject to the Act.[21] Thus, the CA waiver withdrawal is treated as a potential action. Similarly, because it is unclear whether the Trump Administration will disburse uncommitted NEVI funds, we treat permanent withholding of the uncommitted funds ($2.6B of a total of $5.0B appropriated) as a potential action. Finally, the House version of OBBBA included an annual $250 federal fee on EVs as a contribution to the Highway Trust Fund. As mentioned, this provision was not included in the final version of the OBBBA but is under consideration for a surface transportation bill.[7]

Because of model nonlinearities and uncertainty in parameters and input projections, reported point estimates are means from 1000 Monte Carlo simulations in which vehicle demand and charger supply parameters are drawn from distributions taken from the literature where possible and otherwise based on author judgment.

Table 1. Specification of individual policy scenarios

	Policy	2024 Baseline Implementation	Policy Change Scenario (OBBBA; OBBBA + potential)
EV Credits	**IRA 30D:** $3,750 tax credit for consumer EV meeting critical minerals requirements plus $3,750 tax credit for consumer EV meeting battery components requirements, subject to income and MSRP limits **IRA 25E:** Tax credit up to $4,000/30% of sale price for used EV purchased from a dealer for up to $25,000 **IRA 45W:** $7,500 tax credit for commercial EV	Implemented as an expected credit of $5,000.18: • Expected credit of $4,317.50 on purchase for 55% of consumers, based on sales-weighted eligibility across models • Expected credit of $3,000 on lease for 45% of consumers • Expected credit on resale of $4,000, discounted to date of purchase Assumes that 45% of vehicles are leased, used credit fully accrues to seller (original vehicle buyer), and new vehicle credit does not affect vehicle MSRP	Credits removed beginning in 2025 (OBBBA)
Charger Credits	**IRA 30C:** Charging infra-structure tax credit up to: • $1,000/30% of cost for individuals • $100,000/30% of cost for businesses (subject to prevailing wage requirements)	**Individuals:** $450 charger discount at time of vehicle purchase **Commercial chargers:** 30% credit for cost of chargers net of other subsidies	Removed beginning in 2025 (OBBBA)
Production Tax Credit	**IRA 45X:** $35 per kWh of battery capacity for batteries produced and sold in the U.S.	**Cars:** Effective subsidy to consumer beginning at $916.95 in 2023 and growing by $30.56 per year **SUVs:** $1,438.35 in 2023, growing by $47.10 per year Assumes 9-mile increase in range per year, 50% passthrough of production tax credit to consumer price, 62.1% of vehicles eligible	Removed beginning in 2025 (potential)
NEVI	$5 billion in grants for public highway EV charging infrastructure with 80% cost share	80% subsidy to commercial chargers beginning in 2025 (to reflect slow real-world rollout) and lasting until $5 billion is exhausted	Spending capped at $2.385 billion, current committed funding as of 2025 (potential)

	Policy	2024 Baseline Implementation	Policy Change Scenario (OBBBA; OBBBA + potential)
CA Waiver	Pre-Advanced Clean Cars II ZEV requirements: - 2021: 12% - 2022: 14.5% - 2023: 17% - 2024: 19.5% - 2025: 22% ACCII: - 2026: 35% - 2027: 43% - 2028: 51% - 2029: 59% - 2030: 68% - 2031: 76% - 2032: 82% - 2033: 88% - 2034: 94% - 2035+: 100%	Implement 2021-2035+ standards in ZEV states as described above. In 2035 and beyond, the 100% mandate is implemented as a 99.9% mandate, as our model cannot produce a logit share of 100%.	Implement only 2021-2025 standards; cancel ACCII standards. (potential)
EV Fee	$250 annual registration fee for EVs	None at baseline	Beginning in 2026, effective increase in purchase price equivalent to NPV of paying $250 per year for the lifetime of the vehicle (potential)

OBBBA

Our estimates of the impact of the OBBBA appear in Table 2, as well as estimates of the hypothetical standalone elimination of the EV tax credits (personal purchase tax credits plus closing the "leasing loophole") and the residential and business EV charger tax credits, the two IRA provisions reversed by OBBBA. We estimate the impact on EV adoption, avoided CO_2 emissions, and fiscal savings, all versus a December 31, 2024 policy baseline. The estimates in Table 1 assume the CA waiver remains in place. We will subsequently consider the additional impact of withdrawing the CA waiver.

Table 2. Impact of the One Big Beautiful Bill Act (OBBBA)

Scenario	2024 Baseline	Eliminate EV credits	Eliminate Charger credits	OBBBA[1]
2030 EV sales share	48.0%	41.9%	45.3%	39.4%
Change, ppts		-6.2	-2.7	-8.7
2030 EVs on the road (M)	30.9	26.3	28.1	23.7
% Change		*-15.0%*	*-9.0%*	*-23.3%*
Add'l 2030 emissions (mmt)		26.4	15.9	41.0
Fiscal savings 2026-2035 ($B)		169.2	15.6	170.5
per ppt 2030 sales share lost		*27.4*	*5.7*	*19.7*
per add'l mmt CO2		*6.4*	*1.0*	*4.2*

We estimate that OBBBA will slow EV sales, reducing the 2030 EV share of new, light-duty sales to 39.4% from our calibrated baseline of 48.0%, in line with December 31, 2024 policy. The gap of 8.7 percentage points (ppts) is slightly less than the separate effects of removing the EV tax credits (-6.2 ppts) and the business and residential charger investment credits (-2.7 ppts). As a result, OBBBA reduces the number of EVs on the road (registered EVs) by 7.2 million, a 23.3% drop versus our December 2024 policy baseline of 30.9 million.

Fewer EVs on the road mean more emissions in each year. In 2030, emissions would be 41.0 mmt higher as a result of OBBBA. The relative impact of removing only the EV credits or the charger credits is similar to that on the EV sales share.

We estimate that OBBBA saves $170.5 billion in federal expenditures over the 2026-2035 budget window. The savings come overwhelmingly from the elimination of the EV credits, which alone would save $169.2B over the ten-year budget window. In contrast, eliminating the $2.6 billion in charger credits (but keeping the sales and leasing credits in place) would save $15.6B over the same period – more than the direct savings on chargers, because a slower charger rollout would reduce EV sales, in turn yielding savings on the EV tax credits. One reason for the disproportionately high fiscal savings from cutting the IRA EV sales tax credits is that many of these credits represent inframarginal transfers, that is, they go to consumers who would have bought EVs even without the credits and therefore do not generate marginal EV adoption. Another reason is that EV purchase decisions are heavily influenced by the ability to charge: an EV, no matter how low the price, is of little use if it cannot be charged.[3]

Potential Additional Federal Policy Changes

We next consider the effect of potential further changes in federal EV policy in addition to the OBBBA, as shown in Table 3.

Table 3. Potential policy changes added to OBBBA

		+ Eliminate			+ Add	
Scenario	**OBBBA**	**NEVI**	**CA Waiver**	**45X**	**EV fee**	**All**
2030 EV sales share	39.4%	35.1%	38.2%	37.8%	38.3%	30.6%
Change, ppts		-4.3	-1.2	-1.6	-1.1	-8.7
2030 EVs on the road (M)	23.7	21.9	23.7	22.7	23.0	20.1
% Change		*-7.6%*	*0.1%*	*-4.4%*	*-3.0%*	*-15.3%*
Add'l 2030 emissions (mmt)		10.5	0.3	6.0	4.0	21.4
Fiscal savings 2026-2035 ($B)		2.9	0.0	0.0	59.4	54.4
per ppt 2030 sales share lost		*0.7*	*0.0*	*0.0*	*56.4*	*6.2*
per add'l mmt CO2		*0.3*	*0.2*	*0.0*	*15.0*	*2.5*

[1] The CA waiver was repealed in a Congressional Review Act review and has been challeneged in court by the State of California. The waiver withdrawal is therefore treated as a potential action.

Of the potential policy changes, the ending of the NEVI program would have greatest standalone effect on EV adoption, reducing 2030 new EV sales to 35.1%, down another 4.3 ppts from the OBBBA estimate of 39.4%. Terminating the CA waiver would reduce 2030 EV sales by only 1.2 ppts. Removing the 45X battery production and critical mineral processing tax credits (-1.6 ppts) or adding a $250 per year EV fee (-1.1 ppts) would have relatively small effects. Making all four policy changes (NEVI + CA waiver + 45X + EV fee) would reduce 2030 new EV sales by 8.7 ppts vs. the OBBBA baseline, to 30.6%. This result suggests that, in the presence of the other pro-EV policies, the CA waiver's ZEV mandates tend not to bind, whereas they do bind – and therefore drive down emissions – when the other policies are revoked. We further explore this point later.

EVs on the road in 2030 would fall by 7.6% if NEVI were ended, and 15.3% if all the policies were simultaneously adopted, both versus the OBBBA baseline. Removing the CA waiver has a negligible effect on registered EVs, of only 0.1%, after accounting for OBBBA, despite having a material effect on 2030 sales, because the ZEV standards primarily bind after 2030, as we discuss further in the next section. As Figure 1 shows, the impact of removing the CA waiver on EV sales share in ZEV states is negligible until 2030. While the impact on registered EVs is not precisely linear with EV sales share because each policy scenario generates a different trajectory of adoption between today and 2030, the relative impacts of each policy change on total EVs are similar to their impacts on the 2030 EV share of new vehicles.

Even though the fuel efficiency of EVs and ICEs, along with the carbon intensity of the power grid, changes over time, the relative impacts on emissions track total EVs and the 2030 EV share. 2030 carbon emissions would rise by another 10.5 mmt if NEVI ends and 21.4 mmt if all policies combined are adopted. Terminating the California waiver would have little effect.

Imposing a $250 annual federal fee on every EV would raise an estimated $59.4 billion over the 2026-2035 budget window relative to the OBBBA. All policies combined would raise less-$54.4B-because the other policies would further drive down EV sales, reducing the number of registered EVs paying the fee. Ending NEVI saves $2.9 billion while ending the California waiver and 45X have negligible fiscal impact. Note that capping NEVI spending leads to fewer chargers on U.S. roads, which decreases EV adoption and may reduce spending on 45X.

ZEV Mandates and Tradeable Permit Prices

Table 4 shows tradeable ZEV credit prices in 2030 under each scenario in which the CA waiver is not revoked. The estimated credit price is $2,905 in 2030 at baseline. That is, for ZEV states to achieve the mandated ZEV share of 68% in ZEV states in 2030, the purchase of an EV would need to be subsidized by $2,905, and the purchase of an ICE vehicle would need to be taxed by (0.68/(1-0.68))×$2,905 = $6,173.

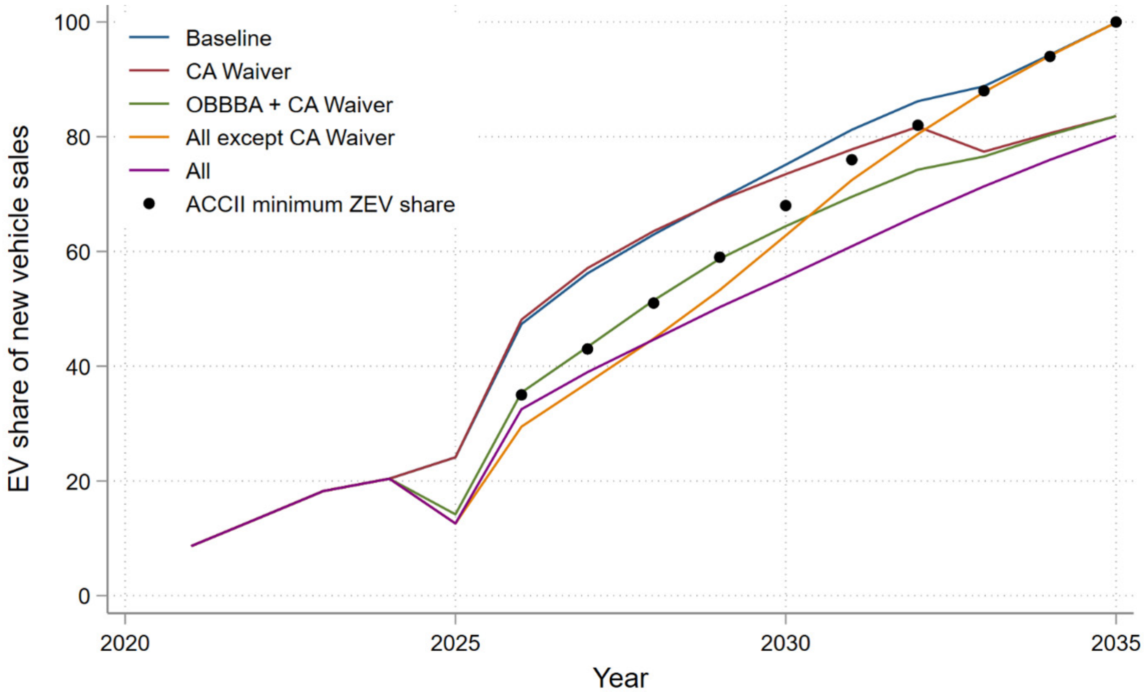
Table 4. Tradeable Permit Prices, 2030: OBBBA and potential additional policy impacts
2024$

	2024	Eliminate			OBBBA + Eliminate		OBBBA + Add
Scenario	**Baseline**	**EV credits**	**Charger credits**	**OBBBA[1]**	**NEVI**	**45X**	**EV fee**
Mean price	2905	4386	3558	5189	6507	5698	5408
Change		*1481*	*653*	*2284*	*4223*	*3414*	*3124*
Median price	0	0	0	7220	9175	7885	7265
Change		*0*	*0*	*7220*	*1955*	*665*	*45*

Tradeable ZEV credit prices would rise by 78.6% as a result of OBBBA, from a December 2024 policy baseline of $2,905 to $5,189. The standalone impact of removing the EV (+$1,481) and charger credits (+$653) reveals this increase to be primarily driven by removing the EV credits.

The high average 2030 permit prices in Table 4 may appear at odds with the fact that revoking the CA waiver has only a minor impact on 2030 EV sales relative to the OBBBA in Table 3 (-1.2 percentage points). This can be reconciled, however, by the fact that, in many of the OBBBA simulations, the ZEV requirements don't bind until after 2030. In the baseline and the EV and charger credits removal scenarios, in fact, the ZEV mandates do not bind in expectation despite high average permit prices, as shown by the median permit prices of 0 in these scenarios in Table 4. To further illustrate this, Figure 1 plots the ACCII required minimum ZEV share (black dots) as well as the EV share of new sales *in ZEV states* under five key policy scenarios: the baseline (blue), the removal of the CA waiver alone (red), OBBBA plus removal of the CA waiver (green), the removal of all policies except the CA waiver (orange), and the removal of all policies (purple).

Figure 1. ZEV state EV share by policy scenario and ACCII ZEV requirement over time



As Figure 1 shows, despite high average ZEV permit prices, the CA waiver has little impact in expectation until after 2030. In the baseline, the EV share in ZEV states stays well above the mandated minimum until 2033, indicating that *in expectation* the CA waiver has no impact in the intervening years if other policies are kept in place. When CA waiver is revoked, the expected EV share in ZEV states drops below the mandated minimum slightly earlier, in 2032, because of the nonzero share of simulations in which the mandate does bind in years before 2033. Even in the OBBBA + CA Waiver scenario, the EV sales share in ZEV states meets ACCII standard in 2026-2028 and misses it by less than one percentage point in 2029. In that scenario, the ZEV state EV sales share only falls significantly short of the standard beginning in 2030.

Revoking the CA waiver has more significant impacts when other policy changes are implemented. In the “All” scenario, the EV share in ZEV states never meets the mandated minimum, so the ZEV requirements would bind immediately if kept in place. Indeed, in the “All except CA Waiver” scenario, the ZEV requirements always bind; in fact, the expected EV share in ZEV states falls *below* the mandated share until 2034 because the tradeable permit price reaches the alternative compliance price of $10,000 in such a high proportion of simulations, meaning that the minimum ZEV share is no longer achieved.

In sum, the role of the CA waiver in EV adoption is minor when other policies are in place and significant when they are removed. The CA waiver does not bind in expectation in 2030 in the baseline, and its impact is only slight until after 2030 even in the OBBBA scenario. In fact, the CA waiver binds in expectation in 2030 whenever the IRA EV credits are removed, suggesting that they play largely the same role as the mandate in ZEV states; when both are in place the CA waiver is redundant, but its impacts become significant once the EV tax credits are removed.

Uncertainty

The estimates presented in Tables 2 and 3 correspond to mean values from 1,000 Monte Carlo simulations of the model. In each simulation, parameter draws are held fixed between the baseline scenario and the alternative policy scenarios in order to generate a range of policy impacts corresponding with the range of possible true parameter values.

Figure 2 plots the impact over time of the OBBBA and each of its two component policies (simulated separately) on the annual EV share of new vehicle sales, plus 50%, 80%, and 90% Monte Carlo bands. All three scenarios have an impact on the EV share of new vehicle sales significantly different from zero in 2030. The trajectory of policy impacts reverts to approximately zero after 2032, when the IRA's EV and charger tax credits would have expired. The policy specifications under OBBBA and its two component scenarios match the December 2024 policy baseline in 2033 and later. This does not, however, mean that the share of EVs on the road would revert to the no-policy baseline after 2032; vehicles have long lives, so policy changes in the short term affect the composition of the light-duty vehicle fleet and resulting carbon emissions for years or decades.

Figure 2. Policy impacts, OBBBA and components relative to December 2024 policy baseline

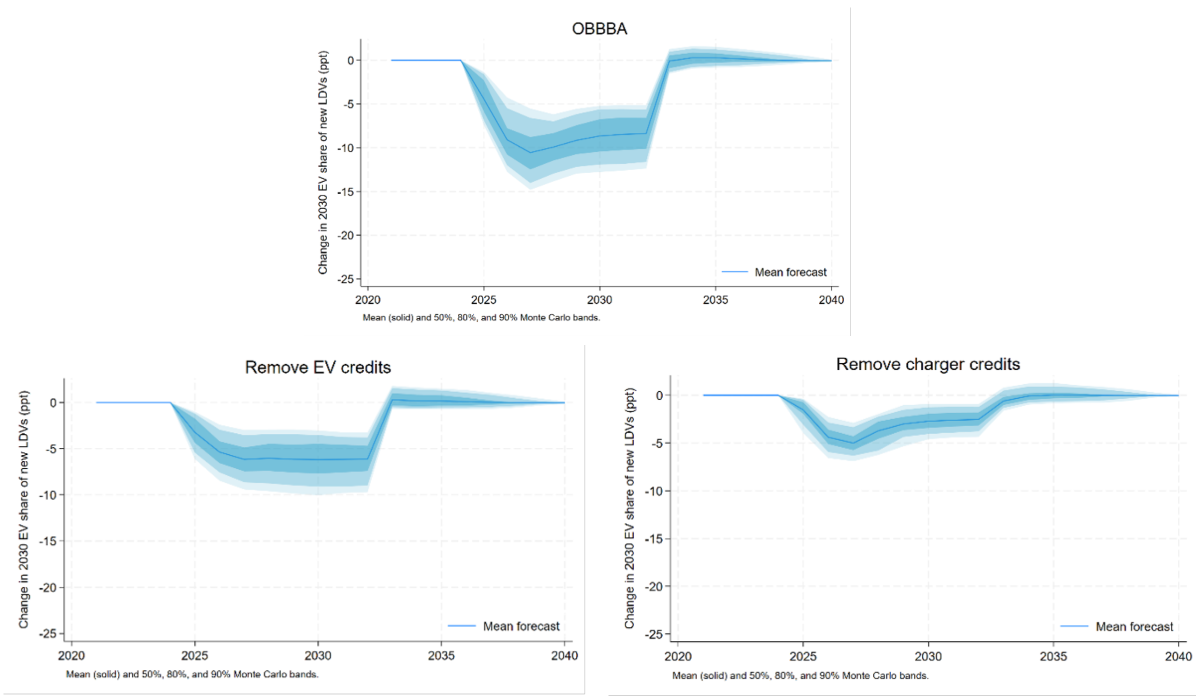
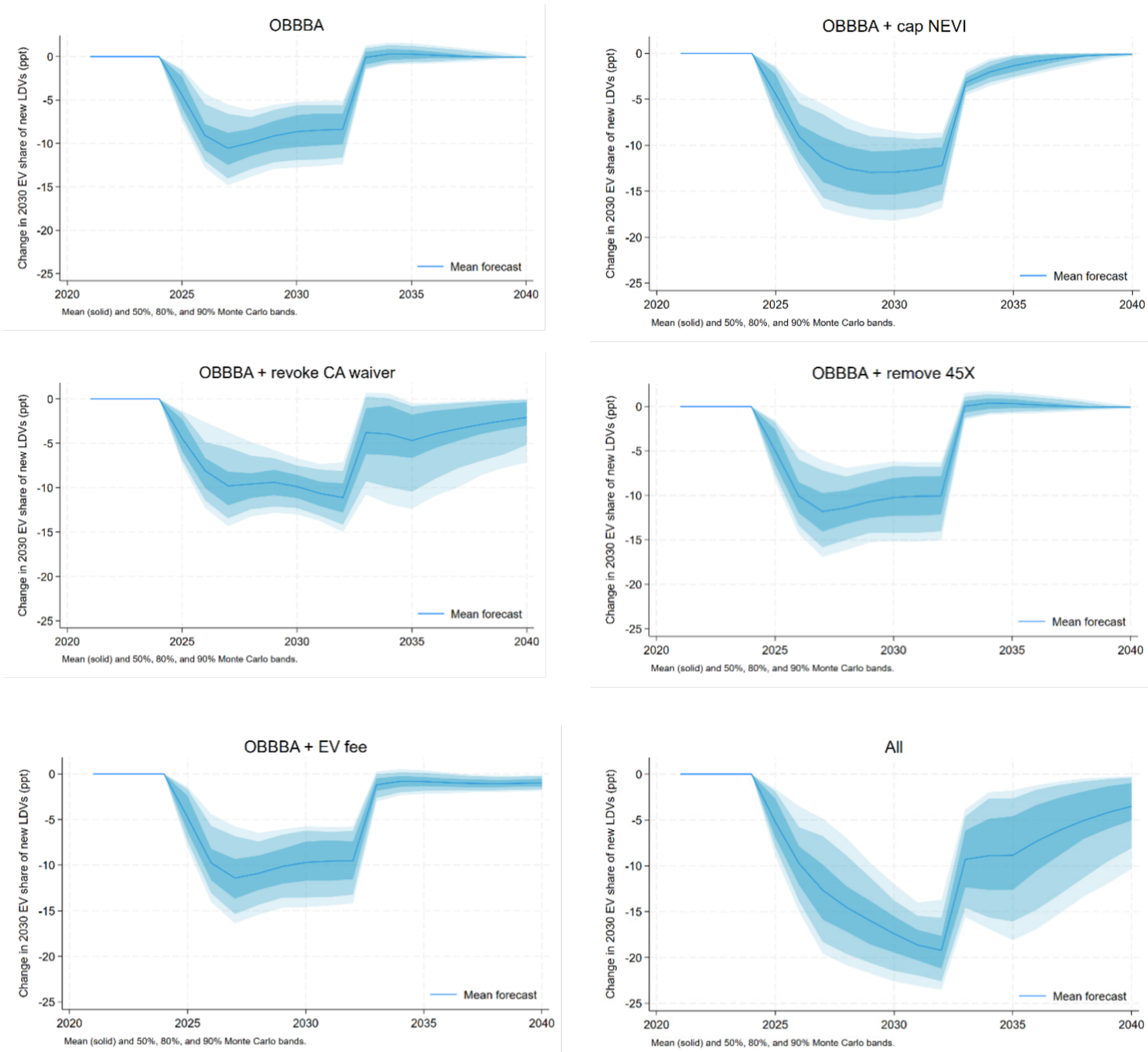


Figure 3 plots the impact over time of combinations of the OBBBA and potential additional policy changes, all relative to the December 2024 policy baseline. Trajectories are similar to Figure 2, as the OBBBA drives the majority of the reduction in EV sales until 2032, when the IRA tax credits would have expired, with several key exceptions. First, capping NEVI ("OBBBA + cap NEVI") makes it take longer for the policy impact to revert to zero after 2032 because fewer chargers on the road means it takes longer for EV sales to catch up to where they would have been after the IRA expired in the December 2024 baseline. Second, policy impacts do not revert to zero after 2032 in scenarios where the CA waiver is revoked ("OBBBA + revoke CA waiver" and "All"). Because the CA waiver binds in more simulations after the IRA tax credits expire, revoking it has substantial impacts all the way through 2040. Finally, the magnitude of impacts is similar through 2032 for each scenario except the "All" scenario. When the IRA *and* NEVI are removed *and* the then-binding CA waiver is revoked, EV sales fall substantially more by 2032 than when any subset of those changes is implemented.

Figure 3. Policy impacts, OBBBA plus additional policies relative to December 2024 policy baseline



Discussion

Our simulations find that, compared to direct vehicle subsidies, policies subsidizing charger buildout have the largest impact on EV adoption with the smallest budgetary impact. This is largely because many of the direct subsidies for vehicles are primarily inframarginal – that is, they are paid to consumers who would have bought electric vehicles even in the absence of the subsidy. For example, the removal of the IRA vehicle credits (30D, 45W, 25E) reduces the EV share of new vehicle sales from 48.0% to 41.9%, which implies that, of the 48.0% of vehicle purchasers who receive credits in 2030 in the baseline, 87.3% would have purchased their vehicle even in the absence of the subsidy, representing a pure transfer from the government to those consumers. This observation aligns with empirical evidence around the introduction of the IRA tax credits.[3]

A similar explanation underlies the relatively small impacts of revoking the CA waiver alone: with other pro-EV policies left in place, our modeling indicates that EV penetration in ZEV states would be close to or above the mandated minimum even without the requirement. For example, in 2026, the first year of ACCII, we find an average EV penetration of 48.1% in ZEV states in the absence of the ZEV mandate provided all other policies remain in place, compared to ACCII's mandated minimum of 35%. In the absence of *all* pro-EV policy and with the addition of the $250 EV fee, on the other hand, EV penetration in ZEV states falls to only 32.5% in 2026, and by 2035 – the year in which ACCII mandates 100% EV penetration – the average EV share of new sales in ZEV states would reach only 80.2%, relative to 83.6% in 2035 when only the CA waiver is revoked. Thus, ACCII is a "belt and suspenders" policy in the sense that it binds only when other pro-EV policies are abolished.

Another noteworthy result is that policy changes in this context have more-than-additive impacts: removing multiple policies has a larger effect than the sum of removing the individual policies. In a standard static model of logit shares for EV penetration, policy changes should be subadditive when EV penetration is less than 50%, as this lies in the convex portion of the logistic function. The two-way-network effect between chargers and EVs effects introduces feedback over time where policies that reduce EV demand reduce future charger buildout, further reducing EV demand. We therefore find in our context that removing multiple policies has a larger effect than the sum of removing the individual policies: on top of the OBBBA, capping NEVI, revoking the CA waiver, removing the production tax credit, and adding the EV fee, for example, has a total negative impact on EV adoption of 8.7 percentage points, greater than the sum of the effects of removing each policy individually (4.3 + 1.2 + 1.6 + 1.1 = 8.1 percentage points). This underscores the importance of jointly modelling all proposed policy changes together, rather than considering each individually.

Overall, given the importance of EV adoption for decarbonization of U.S. transportation – important in turn for mitigating the impacts of climate change – our research presents important lessons on the real (EV penetration and carbon emissions) and budgetary impacts of removing current pro-EV policy. The full menu of policy changes proposed by the Trump Administration poses tradeoffs: some policies are more worthwhile than others in terms of their ratio of budgetary and real impacts, and the impacts of removing individual policies grow when they are coupled with other policy changes.

Methods

Modelling Equations and Calibration

Consumers in vehicle class j (car vs. SUV) in state group s (ZEV vs. non-ZEV) choose to purchase an EV whenever

$$P_{EV,j,t,s}^{\beta_p} N_{t,l3}^{\beta_{l3}} \left(N_{t,l2,s}/Q_{t-1,s}\right)^{\beta_{l2}} exp\left(\psi_{EV,t,s}\right) exp\left(\epsilon_{EV,i,j,t}\right) \geq P_{ICE,j,t,s}^{\beta_p} exp\left(\psi_{ICE,t,s}\right) exp\left(\epsilon_{ICE,i,t}\right)$$

where $P_{c,j,t,ZEV} = P_{c,j,t,non\text{-}ZEV}$ whenever the ZEV mandate does not bind. When the ZEV mandate does bind, $P_{EV,j,t,ZEV} = P_{EV,j,t,non\text{-}ZEV} - p$ and $P_{ICE,j,t,ZEV} = P_{ICE,j,t,non\text{-}ZEV} + p\frac{m}{1-m}$, where p is the tradeable permit price that leads ZEV-state demand to exactly meet the minimum ZEV requirement. $N_{t,l3}$ is the national population of Level 3 chargers, and $N_{t,l2,s}$ is the population of Level 2 chargers in state group s. $Q_{t-1,s}$ is the population of EVs in state group s in the previous year, $\Psi_{c,t}$ is a (calibrated) population-wide time-varying preference for vehicle type c (EV vs. ICE), and $\epsilon_{c,i,t}$ is the type-I extreme value preference for vehicle type c at time t by individual i. These type-I extreme value preference shocks deliver standard logit shares within each vehicle class-by-state group cell which depend on prices and the relevant populations of EVs and chargers. $\Psi_{t,s} = \Psi_{EV,t,s} - \Psi_{ICE,t,s}$ is calibrated so that the ZEV state EV share is 18.24% in 2023, a year in which the ZEV mandate did not bind on average across ZEV states, and so that the overall EV share is 48.0% in 2030. In order to separately identify $\Psi_{t,ZEV}$ and $\Psi_{t,non\text{-}ZEV}$, we require that $\Psi_{t,non\text{-}ZEV} - \Psi_{t,ZEV} = c$, a time-invariant constant.

Level 2 charging stations have a profit function dependent on the local population of chargers and the local population of EVs, plus a calibrated constant:

$$\pi_{t,s}^{l2} = \left(exp(\kappa_2)/N_{t,s}^{l2}\right)^{\frac{1}{\gamma}} Q_{t,s}$$

and Level 3 charging stations have a profit function dependent on the national population of chargers and the national population of EVs, plus a calibrated constant:

$$\pi_{t}^{l3} = \left(exp(\kappa_3)/N_{t}^{l3}\right)^{\frac{1}{\gamma}} Q_{t}$$

This yields three charging station supply equations: Level 3 chargers, Level 2 chargers in ZEV states, and Level 2 chargers in non-ZEV states. Each is derived by equating the benefit of building a station today (this period's profits) with the cost of building a station today (the change in charger cost between this year and next) and takes the following form:

$$ln\left(N_{t,s}^{k}\right) = \kappa_k + \gamma Q_{t,s} - \gamma\left(C_t^k - \frac{1}{1+r} C_{t+1}^k\right)$$

Parameterization

Vehicle pricing projections are based on Bank of America[22] estimates of a 2024 average MSRP of $44,557 for ICE vehicles and $55,338 for EVs, plus their projection of MSRP parity in 2028. To fully parameterize the price path for both types of vehicles, we assume an annual real price growth of 1.35% for ICE vehicles, allowing us to back out the implied annual price growth for EVs, and we assume that SUVs cost on average 1.239 times as much as cars[23] for both powertrain types. Full costs to the consumer are based on this MSRP calculation plus maintenance costs per mile from the *International Council on Clean Transportation*[24], fuel costs (including taxes) based on gas/electricity prices and vehicle efficiency, and any subsidies or taxes imposed by the policy change scenarios. Vehicle efficiency is backed out from CAFE standards for ICE vehicles and held fixed for EVs.

To fully parameterize the model for both ZEV and non-ZEV states, we make the following assumptions:

- 30.2% of LDVs are in ZEV states, based on 2023 vehicle registrations[25].
- Initial EV population is segmented with 56.7% in ZEV states based on 2023 ratio of EV registrations in ZEV and non-ZEV states.
- Initial number of Level 2 chargers in ZEV states calculated as 52.6% of national Level 2 chargers based on AFDC data[26].
- Initial and steady-state number of Level 3 chargers in ZEV states calculated as 43.7% of national Level 3 total based on AFDC data.
- Gas price in ZEV states is 1.181 times gas price in non-ZEV states based on 8 months of state-level gas price data across 2022-2025, scraped from GasBuddy charts using ChatGPT.
- Electricity price in ZEV states is 1.424 times the electricity price in non-ZEV states based on 2024 monthly state-level electricity prices from EIA[27]

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Code availability: Code and data necessary to reproduce results in this paper will be made available via Code Ocean.

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